pteruges, and a Macroglossus, also a species of Scotophilus, probably *S. nigrogriseus*, Gould.

The fishes were not numerous, but some interesting species were obtained, respecting which the Hon. Wm. Macleay read some remarks which will be published in due time.

The insects, about fifty species, will also we hope be taken up by Mr. Macleay. Among the spiders are some very interesting forms, apparently quite new.

The collection of birds numbers about 350 specimens, the mammals about 120. Spirit specimens about 100.

We believe a large portion of this fine collection has been secured by the curator, Mr. E. P. Ramsay, F.L.S., for the Australian Museum.

## *THE SORTING DEMON OF MAXWELL*[1]

THE word "demon," which originally in Greek meant a supernatural being, has never been properly used to signify a real or ideal personification of malignity.

Clerk Maxwell's "demon" is a creature of imagination having certain perfectly well-defined powers of action, purely mechanical in their character, invented to help us to understand the "Dissipation of Energy" in nature.

He is a being with no preternatural qualities, and differs from real living animals only in extreme smallness and agility. He can at pleasure stop, or strike, or push, or pull any single atom of matter, and so moderate its natural course of motion. Endowed ideally with arms and hands and fingers—two hands and ten fingers suffice—he can do as much for atoms as a pianoforte player can do for the keys of the piano—just a little more, he can push or pull each atom *in any direction.*

He cannot create or annul energy; but just as a living animal does, he can store up limited quantities of energy, and reproduce them at will. By operating selectively on individual atoms he can reverse the natural dissipation of energy, can cause one-half of a closed jar of air or of a bar of iron to become glowingly hot and the other ice-cold; can direct the energy of the moving molecules of a basin of water to throw the water up to a height and leave it there proportionately cooled (1° Fahr. for 772 feet of ascent); can "sort" the molecules in a solution of salt or in a mixture of two gases, so as to reverse the natural process of diffusion, and produce concentration of the solution in one portion of the water, leaving pure water in the remainder of the space occupied; or, in the other case, separate the gases into different parts of the containing vessel.

"Dissipation of energy" follows in nature from the fortuitous concourse of atoms. The lost motivity is essentially not restorable otherwise than by an agency dealing with individual atoms; and the mode of dealing with the atoms to restore motivity is essentially a process of assortment, sending this way all of one kind or class, that way all of another kind or class.

The classification, according to which the ideal demon is to sort them, may be according to the essential character of the atom; for instance, all atoms of hydrogen to be let go to the left, or stopped from crossing to the right, across an ideal boundary; or it may be according to the velocity each atom chances to have when it approaches the boundary: if greater than a certain stated amount, it is to go to the right; if less, to the left. This latter rule of assortment, carried into execution by the demon, disequalises temperature, and undoes the natural diffusion of heat; the former undoes the natural diffusion of matter.

By a combination of the two processes, the demon can decompose water or carbonic acid, first raising a portion of the compound to dissociational temperature (that is, temperature so high that collisions shatter the compound molecules to atoms), and then sending the oxygen atoms this way, and the hydrogen or carbon atoms that way; or he may effect decomposition against chemical affinity otherwise, thus: Let him take in a small store of energy by resisting the mutual approach of two compound molecules, letting them press, as it were, on his two hands, and store up energy as in a bent spring; then let him apply the two hands between the oxygen and the double hydrogen constituents of a compound molecule of vapour of water, and tear them asunder. He may repeat this process until a considerable proportion of the whole number of compound molecules in a given quantity of vapour of water, given in a fixed closed vessel, are separated into oxygen and hydrogen at the expense of energy taken from translational motions. The motivity (or energy for motive power) in the explosive mixture of oxygen and hydrogen of the one case, and the separated mutual combustibles, carbon and oxygen, of the other case, thus obtained, is a transformation of the energy found in the substance in the form of kinetic energy of the thermal motions of the compound molecules. Essentially different is the decomposition of carbonic acid and water in the natural growth of plants, the resulting motivity of which is taken from the undulations of light or radiant heat, emanating from the intensely hot matter of the sun.

The conception of the "sorting demon" is purely mechanical, and is of great value in purely physical science. It was not, invented to help us to deal with questions regarding the influence of life and of mind on the motions of matter, questions essentially beyond the range of mere dynamics.

The discourse was illustrated by a series of experiments.

[1] Abstract of Lecture at the Royal Institution, Friday, February 28, 1879, by Sir William Thomson, LL.D., F.R.S.

## *PAOLO VOLPICELLI*

THIS eminent Italian physicist, whose death we recently recorded, was born at Rome on January 8, 1804. He lost his mother a few days after his birth; his father was Prof. Alexander Volpicelli, a member of the Medical College of the Roman University. Paolo was educated at the college of Veroli and the University of Rome, where, in accordance with the wish of his father, he commenced the study of medicine, but abandoned it after the first year, declaring that medicine was not a science. Of his own accord he applied himself seriously to the course of mathematical philosophy, and four years later received the degree of doctor *ad honorem* in that faculty. It should be mentioned that doctorates *ad honorem* are given to only two students each year, and Volpicelli's fellow-doctor was the eminent Professor Tortolini, who followed the same course. Before leaving the University his professors recommended him to the Government for a scientific position. In fact, Prof. Morichini wished to name him his successor to the Chair of Chemistry in the University of Rome, but Volpicelli preferred to succeed Dr. Barlocci, Professor of Experimental Physics in the same University, and in 1845, on the death of Barlocci, became titular professor. Volpicelli occupied this chair till 1873, when he was appointed Professor of Mathematical Physics in the same University. In 1851 he was made a member of the Philosophical College, an honour accorded to only twelve professors of the University of Rome. Besides his position at this University, Volpicelli also filled that of Professor of Mathematical Physics at the Roman Seminary, taught geometry to the pupils of St. Michael's Hospital, and founded at Rome the special School of Artillery, of which he was director for thirty years.

When Pope Pius IX. revived the celebrated and historical Lincei Academy in 1847, Volpicelli was appointed secretary, a post which he held for thirty years, when, as his health was failing, the academicians made him secre-

tary *emeritus*. By his tact and energy at the time of change of government at Rome, he was enabled to save the Archives of the Academy, of which during his lifetime he was one of the most active members.

Volpicelli was well known abroad, and the Emperor of Brazil when in Rome spent some time with the professor, and conferred upon him the grade of officer of the Imperial Order of the Rose. Volpicelli travelled much, and in 1850 he made a long stay in England, where he made the acquaintance of Faraday, Brewster, Airy, Murchison, Sabine, Panizzi, Wheatstone, and others, with whom he afterwards continued to correspond. In France and Switzerland also, he was the friend of the most eminent men of science.

Volpicelli was an energetic worker in his favourite field of electrical research, and to the last maintained with vigour the theory of Melloni, at which he had worked for twenty years. The papers and other works published by Volpicelli were very numerous; no less than 270 are enumerated in a list published by the Academy dei Lincei. Although he is chiefly known by his researches in electricity, these papers show that he did much other work in various departments of mathematics and physics. Volpicelli's papers will be found mainly in the *Atti de l'Accademia dei Lincei*, and the *Comptes Rendus* of the Paris Academy. Very few of them have, however, been translated into English, a circumstance which must be regretted for the sake of English scientific men, to many of whom Volpicelli's researches are known only by name. He died calmly on April 14, having been visited shortly before his death by the Pope's brother, Cardinal Pecci.

## *AN AMERICAN SUGGESTION*

WE have occasionally noted in these columns the formation of mathematical societies, and we have ventured, in our ignorance, to suggest that as a consequence of the great advance in the cultivation of mathematics recently made by our American cousins, the time had come for the formation of an American or (following the analogy of associations nearer home) of a Baltimore Mathematical Society.

A short account of the *Proceedings* at the fifth meeting of the Lehigh Mathematical Society—recorded in the *Bethlehem Daily Times* (Pa.) for March 17—may interest kindred societies on this side the Atlantic, and serve to show that the transactions of such learned bodies may contain "something of importance and profitable (*sic*) to the general reader."

It appears that in order to remedy the defects in the art of surveying, it has been made imperative (so says Mr. S. R. Vay, Civil Engineer, the reader of the paper[1]) by the American legislature that "each county should at its own expense and on its own land, plant, or erect, two monuments of stone, so that the straight line between them should be an exact and due meridian, or north and south line; in order that thereby surveyors, by setting a compass on the one monument, and pointing it to the other, might readily ascertain the deviation or variation of the magnetic needle, and thus be prevented from committing errors in the determination of property lines and landmarks." His soul was much stirred at the neglect of this "scientific duty." It seemed to him that "the scientists of the valley ought to urge, with no uncertain voice, the erection of such or similar monuments. With but little extra expense they could easily be made to interest and to educate, as well as to serve the purpose designed by the legislature. Imagine, for instance, two beautiful granite monuments standing in appropriate situations on the spacious ground of Lehigh University, one mounted with a sun-dial, and the other with an anemometer. On one of them should be cut in plain letters the latitude, longitude, and elevation above the sea of that exact spot. On the other should be recorded a statement of the mean annual temperature and rainfall of the valley. The axis of the sun-dial would not only point to the steadfast pole, but be parallel to the earth's axis; it could, indeed, be furnished with a hoop or circle, to represent the equator, and with others to represent the meridians of Greenwich, Washington, and Bethlehem; a circle to indicate the ecliptic would not be difficult to add, which, by properly constructed clock-work should be always kept parallel to the real ecliptic itself. Thus all who might pass that way would be interested in reading the inscriptions and observing the time, and many would be instructed in the science of astronomy. Even to students it would be of benefit in lightening their mental struggles to grasp, conceive, and understand the idea of the ecliptic circle and the ecliptic plane."

In the discussion which followed, the President doubted the wisdom of the legislature, and thought the better way would be to require higher qualifications from surveyors.

Dr. H. E. Licks inquired the expense of such a sun-dial as Mr. Vay had described.

Mr. A. S. Tronomy said "it was usual to consider the ecliptic as a fixed plane when illustrating the yearly motion of the earth. When considering the daily rotation, however, he could see that Mr. Vay's plan had some advantage."

The next paper was by Prof. Ternion, "On the consequences which would result from denying or reversing the tenth axiom of Euclid." The argument, we learn, was "elaborate and profound, being exemplified by long formulas written on the blackboard." He showed that "if the properties of matter or space were such that the axiom became false, a knot could not be tied in a string, that a hollow rubber ball could be turned inside out without tearing or stretching, and that no satisfactory system of paper or silver money could be employed."

Mr. K. M. Puter considered the paper as an example of mathematical analysis, one of very great value, but he considered it fortunate that we cannot practically reverse the axioms of geometry. "If we could, the results would be disastrous." Our notice of the *Proceedings* at this interesting meeting have extended to some length, but they may be suggestive of matter for societies on this side of the world. We cannot close, without alluding to another feature, and that is the subsequent proceedings (unscientific) before the members separated.

Crackers and cheese were brought forward and the knot untied by the Secretary "without denying any axiom whatever." "The mathematical joke and the hearty laugh were heard," and, tell it not in Gath, they sang a song. Of a Mathematical Society not a hundred miles off, the first President wrote, "not a drop of liquor is seen at our meetings, except a decanter of water; all our heavy is a fermentation of symbols; and we do not draw it mild. There is no penny fine for reticence or occult science; and as to a song! not the ghost of a chance."

## *THE STANDING STONES OF CALLANISH*

THE object of the present paper is to describe the standing stones of Callanish, Island of Lewis, accompanied by notes of such measurements as the author was able to take during a somewhat hurried visit to these very interesting memorials of the early inhabitants of our islands.

Leaving the town of Stornoway, we soon find ourselves amongst great tracts of moorland, with sheets of water large and small on all sides. The deep black peat is being cut and piled up into stacks, when, after being dried, it will serve for the winter's fuel. The peats in the Lewis

[1] Touching first upon the necessity of preserving boundaries and upon the methods employed by the ancients; tracing the word geometry to its source, and relating how the Egyptians were puzzled to find their landmarks, he then passed on to the discovery of the magnetic needle, and the perplexity caused to country surveyors by the deflection of the same.